NOTE: Connecting disk drive to the 820 board - Pin 2 of J1 must be grounded for 5¼" drives. Pin 2 of J1 must be opened for 8" drives.

XEROX PCB #140P82664A

CONSTRUCTION HINTS

The following points must be kept in mind while building the surplus Xerox PC board into a finished unit.

The orientation of ICs is marked by a notch on their legend. Their pin #1s are denoted by a square component pad. The + (positive) end of polarized caps are also indicated by a square component pad.

There are two main types of holes that you will encounter on the PCB. One is a COMPONENT hole the other is a FEEDTHRU. Component holes are larger than a feedthru. Component leads are never inserted in a feedthru !!!

This point is very important since in a few isolated areas it isn't clear from the silk screened legend where one end of a resistor or cap should go. Look at U26 pin 5 (viewed from the top or silksreened side of the PCB). Note the difference in the two holes sizes. The larger is a component pad the smaller is a FEEDTHRU !.

When resistors are put side by side on the PCB (such as R25-R32) they are cut and bent on the SAME centers or dimension. This will also help in determining where a part goes.

Look at R58 and 59 near the top right portion of the board. Where to install R58 is obvious. R59 is mounted below R58, but where does the LEFT end go? What appears to be the correct hole is observed to be a deadly FEEDTHRU ! But by noting the dimension of R58 and size of the holes, you can deduce the the correct hole is directly above the "R" in "R59".

R11 and R60 pose a similar problem. The correct hole for the upper end of R60 is directly below the "R" in "R60". The silk-screened lines indicating component positions have to be shortened from their desired length if they pass directly over a hole. This is why a few points may be misleading at first.

Also, in some spots a part # might be close to two lines. BE CAREFUL and do not mix your Rs and Cs. C48 and R2 next to U29 is a good example. C48 is horizontal while R2 is vertically mounted. Look at C94. Mount it above Q1. R18 mounts above C94. Look at C36. Mount it above "R13". R13 goes below "R13" Take your time!!!

Sometimes due to space, a part # is not as close to its position line as you would like. Y1 and C26 (left of U14) is a VERY good example of this. C26 is mounted below R5 directly above "C26". Y1 is mounted just below "C26". The close spacing of the crystal is a clue here. BE CAREFUL !!!

C72 and C123 next to U117 is another example. The line below "C72" and above "C123" is where C72 is mounted. The tantalum C123 is now obvious (note the "+") as to its position.

The cut trace on the bottom or solder side of the PCB is intentional. U89 pin 6 is cut. This is part of an improved video mod that Xerox came up with. The following jumpers are also required, and were made by Xerox on all production boards we have seen.

Jumper U117 pin 11 to U34 pin 6.

Jumper U45 pin 3 to U34 pin 2.

Jumper U52 pin 14 to U34 pin 4.

Jumper U14 pin 8 to U34 pin 3.

Jumper U34 pin 1 to U34 pin 14.

It is strongly recommended that all ICs be socketed. One of the best forms of trouble shooting is parts substitution, hence the need for sockets. It is easy to bend under a pin when installing an IC in its socket. Take your time here.

You may use the listed AMP connectors when hooking up the board to disks or I/O, but on the disks it might be easier to hard wire the 50 conductor ribbon cable directly to the PCB at J1. Its up to you.

Even though this board will work with 5 1/4 inch drives, it is advised that you use 8 inch drives if possible. The final system may be more reliable and 8 inch software is usually easier to come by. SA800/801 or equiv. are recommended!

If you should be undecided on the placement of a component, even after all of the above hints, the schematics provided and an ohm meter will probably solve your dilemma.

IC's

Parts List: Xerox PCB #140P82664A

U1 - U8 = 4116 Ram (300ns or Better)
U9 - = 74S04
U10 - = 74LS293
U11 - = 74164
U12 - = 74LS290
U13 - = LM339
U14 - = 74S04
U15 - = 74LS32
U16 - = 74LS74
U17 - U24 = 4116
U25 - = 74LS04
U26 - = 74LS74
U27 - = 74LS123
U28 - = 74LS32
U29 - = 74LS04
U30 - = 74LS243
U31 - = 74LS243
U32 - = 74LS08
U33 - = 74LS32
U34 - = 74LS74
U35 - = 74LS373
U36 - = 74LS10
U37 - U44 = 4116
U45 - = 74LS08
U46 - = Z80 CPU
U47 - = 74LS241
U48 - = 74LS283
U49 - = 74LS393
U50 - = 74LS161
U51 - = 74LS74
U52 - = 74LS290
U53 - = 74LS393
U54 - U61 = 4116
U62 - = 74LS138
U63 - = 2716 Rom 1 (Monitor)
U64 - = 2716 Rom 2 (Monitor)
U65 - = 74LS174
U66 - = 74LS283
U67 - = 74LS157
U68 - = 74LS157
U69 - = 74LS157
U70 - = 74LS157
U71 - U72 = 74157 (Not "LS" !)
U73 - = 8216
U74 - = 74LS20
U75 - = 74LS138
U76 - = 8216
U77 - = 74LS00
U78 - = 74LS00
U79 - = 74LS02
U80 - = 74LS138
U81 - = 74LS241
U82 - U83 = 74LS243
U84 - U87 = 2114 (300ns)
U88 - = 74LS138
U89 - = 74LS04
U90 - = 74151
U91 - = 74LS174
U92 - = 2716 Char. Rom
U93 - = 74LS193
U94 - = 74LS08
U95 - = MC1489
U96 - = Z80 SIO/0 (Or Dart)
U97 - = Com 8116 (SMC)
U98 - = 74LS04
U99 - = Z80 CTC
U100 - = 74LS243
U101 - = Z80 PIO
U102 - = 74LS243
U103 - = 74LS86
U104 - = 74LS14
U105 - = Z80 PIO
U106 - = 74LS123
U107 - = 74LS157
U108 - = 74LS14
U109 - = WD1771 F.D.C.
U110 - = 74LS242
U111 - = MC1488
U112 - = MC1489
U113 - = MC1488
U114 - = 74LS243
U115 - = 74LS243
U116 - = 74LS14
U117 - = 7406 or 7416
U118 - = 7406 or 7416
U119 - = 74LS242

CAPS

Parts List - Xerox PCB #140P82664 A

C1 - C16 = .1mfd Bypass
C17 - C22 = .1mfd
C23 - = 6.8mfd Tant.
C24 - = .1mfd
C25 - = 6.8mfd Tant.
C26 - = 100pf
C27 - = Not Used
C28 - C35 = .1mfd
C36 - C37 = .1mfd
C38 - = Not Used
C39 - C40 = .1mfd
C41 - C42 = 6.8mfd Tant.
C43 - = .1mfd
C44 - C45 = 6.8mfd Tant.
C46 - C49 = .1mfd
C50 - C57 = .1mfd
C58 - = .1mfd
C59 - C61 = .1mfd
C62 - C63 = 6.8mfd Tant.
C64 - = .1mfd
C65 - C66 = 6.8mfd Tant.
C67 - C68 = .1mfd
C69 - = .1mfd
C70 - = .1mfd
C71 - = Not Used
C72 - = 120pf
C73 - C80 = .1mfd
C81 - C84 = .1mfd
C85 - = 6.8mfd Tant.
C86 - = .1mfd
C87 - = 6.8mfd Tant.
C88 - C89 = .1mfd
C90 - = 47pf
C91 - C93 = Not Used
C94 - = 33pf
C95 - C102 = .1mfd
C103 - C110 = .1mfd
C111 - C116 = .1mfd
C117 - = .01mfd
C118 - = .0033mfd (3300pf)
C119 - C122 = .1mfd
C123 - = 6.8mfd ± 10% Tant.
C124 - = 1.0mfd (Al. Elect.)
C125 - C126 = .1mfd
C127 - = 390pf
C128 - = 390pf
C129 - = .1mfd
C130 - = 390pf
C131 - = 1.0mfd (AL. Elect.)
C132 - = .1mfd
C133 - = .1mfd
C134 - = 68mfd Tant.
C135 - C136 = 68mfd 10V (Al. Elect.)
C137 - C144 = .1mfd
C145 - C152 = 390pf
C153 - = .1mfd
C154 - C157 = 390pf
C158 - C181 = .1mfd
C182 - C189 = .1mfd
C190 - C191 = .1mfd
C192 - = Not Used
C193 - C196 = .1mfd

Note: The bypass caps listed above as .1 mfd actually can be any value from .01 to .47 mfd. as long as they fit the board.

RESISTORS

Parts List - Xerox PCB #140P82664 A

R1 - 68 ohm
R2 - 10 K
R3 - 68 ohm
R4 - 910 ohm
R5 - 910 ohm
R6 - 4.7 K
R7 - 10 K
R8 - 10 K
R9 - 10 K
R10 - 100 ohm
R11 - 7.5 K
R12 - 10 K
R13 - 33 ohm
R14 - 100 ohm
R15 - 10 K
R16 - 910 ohm
R17 - 910 ohm
R18 - 1.2 K
R19 - 220 ohm
R20 - 22 ohm
R21 - 10 K
R22 - 120 ohm
R23 - 7.5 K 2%
R24 - 10 K 2%
R25 - R32 - 33 ohm
R33 - 180 ohm
R34 - 10 K
R35 - 10 K
R36 - 10 K
R37 - Not Used
R38 - 10 K
R39 - 10 K
R40 - 10 K
R41 - 220 K
R42 - 1 K
R43 - 220 ohm
R44 - 10 K
R45 - 10 K
R46 - 220 ohm
R47 - R48 - 10 K
R49 - 10 K
R50 - R57 - 10 K
R58 - R59 - R60 - 150 ohm
R61 - R65 - 150 ohm
R66 - R67 - 10 K
R68 - R69 - 4.7 K

MISCELLANEOUS

Parts List: Xerox PCB # 140P82664A

Y1 - = 10.69425 MHz Crystal (HC-18)
Y2 - = 20.000 MHz Crystal (HC-18)
Y3 - = 5.0688 MHz Crtstal (HC-18)

Q1 - = 2N2905

VR1 - = 1N5221B or Equivalent
VR2 - = 1N5231B or Equivalent

E1 & E2 = Normally Jumpered

J1 - = Amp 206817-1
J2 - J4 = Amp 206584-2
J5 - = Molex
J6 - = Molex
J7 - = 10 Pin .1 In. Pin To Pin, and .1 Row to Row
J8 - J9 = 40 Pin (20 Pin Each Row) .1 Spacing as J7
J10 - = As J7 10 Pin
J11 - = 20 Pin .1 Spacing as J7

S1 - = DPDT Reset Switch

--INTRODUCTION--

The XEROX 820 system monitor is the basic control program for the single-board computer. It begins execution when the computer is first turned on, or whenever the reset button is pressed, and resides in the top 4K of memory.

The monitor provides two essential functions for the system. It is the initial software level of the computer and it contains the routines that initialize and control all the basic system input/output resources. The "front panel" functions of the monitor include commands to display and alter the contents of memory and I/O ports, to begin execution at a given address, and to bootstrap programs from disk. The basic I/O functions of monitor provide driving routines for the built-in CRT display and keyboard input, and the floppy disk controller. In this capacity the monitor is always active, even when application programs like the CP/M disk operating system have control of the CPU.

The following sections of this manual will explain how to use the console monitor commands, what facilities are provided by the resident I/O handlers, and how to interface applications programs to the monitor.

XEROX 820 MONITOR COMMAND SUMMARY

The Xerox 820 monitor enters the command mode after it has initialized the system following a power-on or a reset. The following sign-on message is displayed on the console output device as an indication that the monitor is ready to accept commands.

```
. . . XEROX 820 . . .
Enter A for BOOT
Enter T for TYPEWRITER
* _
```

Commands consist of a single character command name and zero to three hexadecimal numeric parameters separated by commas or spaces. The command line may be entered using upper case or lower case letters. A carriage return is used as the terminator. Errors within a line can be corrected by typing control-H to delete the last character or control-X to delete the entire line. If a line is entered with an unknown command name, an invalid number or parameters or an out-of-range parameter, an error message will be displayed and the command will not be executed.

The user may wish to halt long running commands like the memory dump before they are finished. This can be done by typing carriage return while the command is doing output. Output can also be frozen temporarily and then re-started by typing repeatedly on the space bar.

The following table summarizes the monitor's command set. The items enclosed in angle brackets represent the numeric parameters expected by the command. A detailed description of each command is provided in the following pages.

command		format
d(ump)	...	D (start), (end)
m(emory)	...	M (address)
t(est)	...	X (start), (end)
f(ill)	...	F (start), (end), (constant)
c(opy)	...	C (source_start), (source_end), (dest_start)
g(oto)	...	G (address)
r(ead)	...	R (unit), (track), (sector)
a(boot)	...	A(boot) from A drive
t(ypewriter)	..	T
i(nput)	...	I (port)
o(utput)	...	O (port), (data)

NOTE: All of the Monitor parameters are hexadecimal.

1) **DUMP COMMAND**

The dump command outputs a tabular display of the contents of memory in hexadecimal and ASCII representation. Each display line has the following format:

AAA DD DD DD DD DD DD DD DD DD DD DD DD DD DD DD DD CCCCC

where AAAA is the starting memory address of the line in hexadecimal, the DD's are the hex values of the 16 bytes of data starting at location AAAA, and the C's are the ASCII characters equivalent to each data byte. Bytes less than 20 hex are replaced in the ASCII portion of the dump by period.

The dump command accepts zero, one or two address parameters. If two addresses are specified, the block of memory between those two locations will be dispayed. Entering only one address will display 256 bytes of memory starting at the specified location. Typing 'D' with no parameters will cause the routine to display the 256 byte block of memory starting at the last address displayed by the dump command.

2) MEMORY COMMAND

The memory examine/change command allows the contents of individual memory locations to be read from and written into using the monitor. This command accepts one parameter representing the memory address at which to begin examining data. The display format is as follows:

AAAA DD _

where AAAA is the current memory address and DD is the hexadecimal value of the data in that location. After displaying the contents of a memory location, the routine waits for one of the following items to be input from the console.

- o Typing a carriage return will cause the routine to display the data at the next memory location, with no modification of content.
- o Typing a minus sign will have a similar effect, except the address is decremented instead of incremental.
- o Typing a two digit hexadecimal number will cause that number to be stored at the displayed address. The new data is stored as soon as the second digit is entered, with no terminating character required.
- o Typing any character other than carriage return, a minus sign or a hexadecimal digit will cause the command to terminate.

3) TEST COMMAND

This command allows the user to test memory for errors caused by defective 16K memory chips, solder bridges and various other problems. Any portion of memory may be tested except the area reserved for the monitor (F000 to FFFF hex). Two parameters are required from the user; the starting address and ending address of the memory block to be tested. Only the high order 8 bits of the addresses entered are actually used however, due to a characteristic of the test algorithm begin employed. If no errors occur, the test routine will output a plus sign every time a test pass is done. A total of 256 plus signs must be output for all possible test patterns to have been tried. When errors are detected an error line will be output in the following format:

AAAA DD should=XX

where AAAA is the address of a location that fails to test, DD is the data read back from the location, and XX is the test pattern that was written there.

4) FILL COMMAND

The fill command allows blocks of memory to be filled with a fixed data constant. Three parameters are required in the command line; a starting memory address, an ending address and a fill constant. Each location in the specified block of memory has the constant written into it and then read back again to check for memory errors. An error line like the one described for the 'X' command is printed for any locations that fail to verify.

5) COPY COMMAND

The copy command allows blocks of data to be moved around in memory. Three parameters are required in the command line; a starting memory address, an ending address, and a destination address. The contents of the block of memory bounded by the first two addresses is copied to the block starting at the third address. As with the fill command, a test is made to verify that each byte of the destination block, when read back, is the same as the corresponding byte in source block.

8) GO TO COMMAND

The goto command allows control of the CPU to be passed to another program by the monitor. This command requires a single parameter from the user representing the address at which to begin execution. The monitor actually passes control to the specified location by executing a CALL instruction. This makes it possible for the external routine to return to the monitor by doing a RET, assuming it does not re-load the stack pointer and loose the return address to the monitor.

9) READ COMMAND

The read command allows individual disk sectors to be read into memory and displayed on the console. Three parameters are required; a drive unit number (range 0 to 1), a track number (range 0 to 27 for 5.25" disks or range 0 to 4C for 8" disks) and a sector number (range 1 to 12 for 5.25" disks or range 1 to 1A for 8" disks). The command routine performs a drive select, track seek and sector read sequence using the supplied parameters. If no errors occur, the contents of the input buffer will be dumped out the 'D' command format. In the event of a disk error, a diagnostic message will be printed in the following format:

disk error XX UAA TBB SCC

where XX represents the 1771 disk controller error status code, AA is the unit number, BB is the track number, and CC is the sector number. The error code is composed of eight bits of status information as described in the table below:

bit	read/write	seek/restore/select
7	drive not ready	drive not ready
6	write protected	unused
5	write fault	unused
4	record not found	seek error
3	crc error	crc error
2	lost data	cannot restore
1	unused	unused
0	always=1	always=0

The least significant bit (LSB) of the error code indicates which of the above sets of error conditions is applicable. If the LSB=1 the disk error was generated by a read or write operation, otherwise it was caused by a seek, restore, or select operation.

10) BOOT COMMAND

The boot command command is used to load and begin execution of a one sector long bootstrap loader from the first sector on drive unit zero. The most common use of this command will be to boot up the CP/M disk operating system, although it is not necessarily restricted to this purpose only.

The boot works by reading the contents of track 0, sector 1 into memory at location 80 hex and the jumping to that address to start execution of the code just read in. Normally the routine on sector 1 will be a small loader that in turn reads in a larger program such as the operating system. This two level bootstrap process makes the boot command more application independent. The only requirements are that the first sector of the boot diskette be reserved for a loader and that the bottom 256 bytes of memory are not written over by the program being loaded.

11) TYPEWRITER COMMAND

This command allows the XEROX 820 to be used as a standard electronic typewriter. All key strokes will be typed directly on the attached printer in a direct print mode, without displaying any typed information on the screen.

12) INPUT COMMAND

This command allows the contents of input ports to be read from using the monitor. It operates very much like the memory examine command, except that input ports are being examined instead of memory locations. A single parameter representing a port number is expected in the command line. The contents of adjacent ports can then be examined by typing carriage return or a minus sign as in the 'M' command. Typing any other key will cause the routine to terminate.

13) OUTPUT COMMAND

The output command is provided to allow output ports to be written to using the monitor. Two parameters are expected in the command line; a port number and a data byte to be output to that port. Both parameters should be between 0 and FF hex. After outputting the specified data to the port, this routine simply returns to the monitor instead of stepping to the next location like the input command. This makes it possible to use the output command to initialize Z-80 peripheral devices like the SIO, PIO and CTC.

MONITOR RESIDENT I/O DRIVER FUNCTIONS

This section describes the facilities available in the XEROX 820 monitor for controlling the input/ouput resources of the XEROX 820 single-board computer.

1) INTERRUPT PROCESSING

The XEROX 820 monitor takes advantage of the powerful interrupt handling capabilities of the Z-80 microprocessor. Interrupts are utilized in the I/O drivers for the console keyboard input, the real-time clock and the floppy disk controller. All necessary initialization tasks and interrupt service routines for these devices are contained in the monitor.

For the most part, the operation of the interrupt mechanism should be transparent to most applications programs that will run under XEROX 820. A few precautions must be taken however, to insure that user written software does not adversely effect the operation of the system. The following list describes the major hazards to the interrupt system;

- o Interrupts should not be disabled permanently by user code, as this will lock-up the console input and real-time-clock routines.
- o The Z-80 'I' register should never be altered. Doing so is GUARANTEED to crash the system.
- o The CPU operates in Z-80 interrupt mode 2 and should not be switched to either of the other two interrupt modes.
- o Adequate stack space must be reserved in user programs to allow at least one level of stack for interrupt return addresses. Use of the stack pointer for 'trick' programming purposes is highly discouraged for the same reason.

The monitor initializes the Z-80 'I' register to point to the system interrupt vector table at location FF00 to FF1F hex. This table contains pre-assigned vector locations for all the peripheral devices on XEROX 820, including those that are not used by any built-in functions in XEROX 820. The devices that are not currently used include SIO channel A, the general purpose PIO and CTC channels 0 and 1. These ports can be initialized and used as needed without affecting the overall system operation. Consult the monitor variables table at the end of this manual for the vector addresses.

2) MEMORY MAPPED VIDEO DISPLAY

The XEROX 820 single-board computer is equipped with a built-in 80 character by 24 line CRT display controller, for use with an external video monitor as the system console output device. The refresh memory for the CRT is bank switchable from the system's 64K byte memory space and includes a hardware address translation circuit for high speed scrolling.

The XEROX 820 monitor contains an output driver routine for the CRT that emulates the characteristics of a typical stand-alone video terminal. An operational summary of the CRT driver is given on the next page.

- All character codes between 20 and 7F hex are directly displayable on the screen. Characters are formed in a 5x7 dot matrix.
- New characters are stored on the screen at the location occupied by the cursor. The cursor is then moved one place to the right.
- If the cursor must appear at a screen position occupied by a non-blank character, the presence of the cursor will be indicated by making the overlayed character blink on and off.
- If the displayable character is output when the cursor is in the right-most column of the screen, an automatic carriage return and linefeed is generated afterwards.
- If a linefeed in output when the cursor is on the bottom line of the screen, the entire display is scrolled up one line and a new blank line is created on the bottom.
- All character codes between 00 and 1F hex are interpreted as control characters. Only 12 of these codes have some effect on the CRT display, and are described in the table below. The remaining 20 are treated as nulls.

CODE	KEY	NAME		EFFECT
00	@	NUL	-	NONE
01	A	SOH	-	NONE
02	B	STX	-	NONE
03	C	ETX	-	NONE
04	D	EOT	-	NONE
05	E	ENQ	-	NONE
06	F	ACK	-	NONE
07	G	BEL	-	NONE
08	H	BS	-	BACKSPACE OR CURSOR LEFT
09	I	HT	-	HORIZONTAL TAB
0A	J	LF	-	LINEFEED OR CURSOR DOWN
0B	K	VT	-	CURSOR UP
0C	L	FF	-	CURSOR RIGHT
0D	M	CR	-	CARRIAGE RETURN
0E	N	SO	-	NONE
0F	P	SI	-	NONE
10	P	DLE	-	NONE
11	Q	DC1	-	CLEAR TO END OF SCREEN
12	R	DC2	-	NONE
13	S	DC3	-	NONE
14	T	DC4	-	NONE
15	U	NAK	-	NONE
16	V	SYN	-	NONE
17	W	ETB	-	NONE
18	X	CAN	-	CLEAR TO END OF LINE
19	Y	EM	-	NONE
1A	Z	SUB	-	CLEAR SCREEN
1B		ESC	-	ESCAPE SEQUENCE
1C		FS	-	NONE
1D		GS	-	NONE
1E		RS	-	HOME CURSOR
1F	_	VS	-	DISPLAY CONTROL CHARACTER

Backspace:

Moves the cursor to the next column to the left. If the cursor is in the leftmost column of the screen, this character has no effect.

Tab:

Moves the cursor right to the next tab stop. The tab stops are fixed at every eighth column, starting from the left.

Linefeed:

Moves the cursor down one line on the screen. If the cursor is the bottom-most line, the screen is scrolled up and a blank line is created on the bottom. The top line is lost.

Cursor Up:

Moves the cursor up one line on the screen. If the cursor is on the top of the screen it rolls around to the bottom.

Cursor Right:

Moves the cursor to the next column to the right. If the cursor is in the rightmost column, there is no effect.

Carrier Return:

Moves the cursor to the leftmost column of the screen.

Clear to EOS:

Clears the contents of the screen from the current cursor position to the end of the bottom line.

Clear to EOL:

Clears the contents of the line the cursor is on, from the cursor position to the end of the line.

Clear Screen:

Clears the entire screen regardless of the current cursor position and places the cursor in the top left corner of the screen. Also re-initializes the CRT driver subroutine.

Escape:

Used to initiate an XY cursor positioning sequence. The cursor can be moved to an arbitrary location on the screen by outputting a 4 character sequence composed of 1) escape, 2) equals sign, 3) row# character and 4) column# character. The row/column number characters are formed by taking the desired row# (range=0 to 23) or column# (range=0 to 79) and adding 20 hex (32 decimal) to it.

Home Cursor:

Moves the cursor to the top left corner of the screen, without altering any characters on the display.

Display CC's:

Functions as a prefix character to force the output of symbols in the character generator that corresponds to ASCII control characters. The next character output to the CRT after outputting a 1F hex will be displayed on the screen regardless of its numeric value. If multiple symbols are to be displayed, 1F must precede each character.

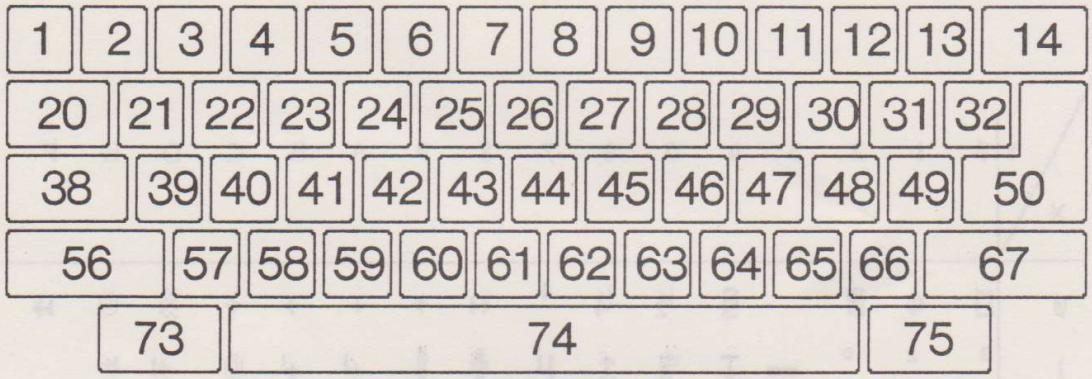
DISPLAY CHARACTER CODES

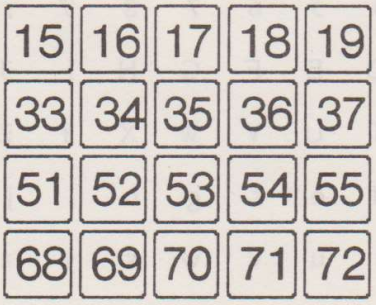
This table shows the code for each character to be displayed by the XEROX 820. Each character is defined by a unique eight bit code which is represented by a hexadecimal code 'XY' where X represents the 4 most significant bits of the code and Y represents the 4 least significant bits of the code.

There are a total of 128 characters in the font se t. Therefore, Y represents a hexadecimal number from Ø to F, and X represents a hexadecimal number from Øto 7. Therefore, the complete font set is defined by codes from ØØ to 7F. If the most significant bit of the eight bit code is set to '1', then the complete font set is duplicated with the blink attribute set. The blinking set of characters is then defined by codes from 8Ø to FF.

X \ Y	Ø	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
Ø	□	¢	■		§	½	¼	±	↤	↑	↓	→	←	▒	®	↦
1	³	²	◇	▬	↧	¶	↥	µ	╋	▌	↵	↵	©	⇥	⇤	
2		!	"	#	$	%	&	'	(	)	*	+	,	-	.	/
3	Ø	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
4	@	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
5	P	Q	R	S	T	U	V	W	X	Y	Z	[	\	]	^	_
6	`	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
7	p	q	r	s	t	u	v	w	x	y	z	{	|	}	~	™

KEY STATION NUMBERING





KEY CODES

KEY NAME	KEY #	UNSHIFTED	SHIFTED	CONTROL
HELP	01	1E	1E	9E
1	02	31	21	91
2	03	32	40	92
3	04	33	23	93
4	05	34	24	94
5	06	35	25	95
6	07	36	5E	96
7	08	37	26	97
8	09	38	2A	98
9	10	39	28	99
0	11	30	29	90
MINUS	12	2D	5F	1F
EQUAL	13	3D	2B	9A
BACKSPACE	14	08	08	88
DELETE	15	7F	7F	FF
- (PAD)	16	2D	2D	AD
7 (PAD)	17	37	37	B7
8 (PAD)	18	38	38	B8
9 (PAD)	19	39	39	B9
TAB	20	09	09	89
Q	21	71	51	11
W	22	77	57	17
E	23	65	45	05
R	24	72	52	12
T	25	74	54	14
Y	26	79	59	19
U	27	75	55	15

Key Codes
(continued)

KEY NAME	KEY #	UNSHIFTED	SHIFTED	CONTROL
I	28	69	49	09
O	29	6F	4F	0F
P	30	70	50	10
[	31	5B	7B	1B
]	32	5D	7D	1D
ESC	33	1B	1B	9B
+ (PAD)	34	2B	2B	AB
4 (PAD)	35	34	34	B4
5 (PAD)	36	35	35	B5
6 (PAD)	37	36	36	B6
LOCK	38	---	FUNCTION KEY	---
A	39	61	41	01
S	40	73	53	13
D	41	64	44	04
F	42	66	46	06
G	43	67	47	07
H	44	68	48	08
J	45	6A	4A	0A
K	46	6B	4B	0B
L	47	6C	4C	0C
SEMICOLON	48	3B	3A	7E
APOSTROPHE	49	27	22	60
RETURN	50	0D	0D	8D
LINEFEED	51	0A	0A	8A
UP ARROW	52	01	01	81
1 (PAD)	53	31	31	B1
2 (PAD)	54	32	32	B2

Key Codes
(continued)

KEY NAME	KEY #	UNSHIFTED	SHIFTED	CONTROL
3 (PAD)	55	33	33	B3
L SHIFT	56	---	FUNCTION KEY	---
Z	57	7A	5A	1A
X	58	78	58	18
C	59	63	43	03
V	60	76	56	16
B	61	62	42	02
N	62	6E	4E	0E
M	63	6D	4D	0D
COMMA	64	2C	3C	1C
PERIOD	65	2E	3E	7C
SLASH	66	2F	3F	5C
R. SHIFT	67	---	FUNCTION KEY	---
L. ARROW	68	04	04	84
D. ARROW	69	02	02	82
R. ARROW	70	03	03	83
0 (PAD)	71	30	30	B0
. (PAD)	72	2E	2E	AE
L. CTRL	73	---	FUNCTION KEY	---
SPACE BAR	74	20	20	00
R. CTRL	75	---	FUNCTION KEY	---

3) PARALLEL KEYBOARD INPUT

A parallel keyboard interface is provided on XEROX 820 for systems that will use the built-in keyboard and CRT display as the console I/O device This interface is designed to connect to an ASCII encoded keyboard with 8 bits of parallel data and a key-pressed strobe.

The XEROX 820 monitor contains an interrupt driven input handler for the keyboard that maintains a 16 character deep FIFO buffer for input data. This makes it possible to do a considerable amount of typing ahead without any input characters being lost. If characters are typed while disk access is going on, they may be lost because the disk routines lock out all lower priority interrupts. Any characters received when the FIFO is full will also be lost.

4) FLOPPY DISK CONTROLLER

The system is equipped with an on-board floppy disk interface capable of controlling up to two Shugart compatible 8 inch drives, or two 5¼" drives. The interface hardware is based on a Western Digital 1771 disk controller chip, along with extra TTL support circuitry to provide buffering, drive select, head load timing and data separater functions.

The XEROX 820 monitor contains a complete I/O driver package for the disk controller. Linkage to the disk I/O routines in the monitor is provided by a set of subroutine entry points described later in this manual. The basic functions available are: drive select, restore, seek, track, read sector, and write sector. The user can also specify the track-to-track seek stepping rate, and the sector record length.

All disk functions are verified upon completion, with the final status being returned in the A register. If the command was executed successfully, then A will contain all zeros on return, otherwise it will contain an error status byte as described above under the console monitor 'R' command. The disk driver routines will attempt to recover from any disk I/O errors that occur, so it is generally not necessary for user written programs to try to re-execute commands that fail the first time.

DISK FORMAT

The XEROX 820 is equipped with two (2) compatible Shugart SA400L (5¼") drives, or two (8") Shugart SA800 drives. The disks for the SA400L (5¼") drives are initialized in a CROMEMCO format, and the disks for the SA800 (8") disks are initialized in an IBM 3740 format.

A format is divided into three (3) parts, field A, field B, and field C. Field A is written at the start of each track known as the preamble. Field B is written once for each sector which consists of a gap between sectors, ID fields, and a data field. Field C is written at the end of each track and is known as a postamble.

The XEROX 820 disks are initialized in the following formats :

Parameter	8"	5¼"
Tracks	77	40
Sectors	26	18
Bytes/Sector	128	128
# of Reserved Track for OS	2	3
Disk Capacity	241K	81K

5¼" Format

	Number of Bytes	Hex Value of Bytes	Comment
Field A -	16	FF	Preamble on Gap 4A
*Field B	4	00	Gap 3
	1	FE	ID Address Mark
	1	XX	Track #
	1	00	
	1	XX	Sector #
	1	00	
	1	F7	Generate CRC
	11	FF	Gap 2
	6	00	
	1	FB	Data Address Mark
	128	E5	Data Field 'E5' Data
	1	F7	Generate CRC
	8	FF	Gap 8
Field C -	101	FF	Postamble Gap 4B

8" Format

	Number of Bytes	Hex Value of Bytes	Comment
Field A -	28	FF	Preamble - Write at the
	6	00	start of each track
	1	FC	
	26	FF	
*Field B	6	00	Gap 3
	1	FE	ID Address Mark
	1	XX	Track #
	1	00	
	1	XX	Sector #
	1	00	
	1	F7	Generate CRC
	11	FF	Gap 2
	6	00	
	1	FB	Data Address Mark
	128	E5	Data Field '5' Data
	1	F7	Generate CRC
	27	FF	Gap 3
Field C -	247	FF	Postamble Gap 4B

* Repeated for one (1) number of sectors per track.

5) SERIAL INPUT/OUTPUT

The XEROX 820 single-board computer has provisions for two completely independent RS-232 serial ports that can be used to interface to printers, CRT terminals and data communications equipment.

6) REAL TIME CLOCK

The XEROX 820 single board computer has Z-80 CTC device that can be used to generate the timebase for interrupt driven timers, real-time clocks, and other time keeping functions. The monitor will initialize CTC channels 2 and 3 to interrupt the processor once a second. Channels 0 and 1 of the CTC are not initialized and can be used for other purposes.

The one second interrupt from the CTC is utilized by the monitor's disk I/O routines to implement the disk motor turn-off function.

7) PARALLEL I/O OPTION

A Z-80 PIO chip has been included on the XEROX 820 for general purpose I/O interfacings. This device is completely unused by any built-in functions. The PIO contains two independent 8 bit parallel I/O ports that can be used to interface to printers, ROM programmers, analog converters, other computers, or just about anything else imaginable. Those interested in using the PIO should consult the schematic drawings for any needed hardware interfacing details. Data about programming the PIO can be found in most Z-80 applications manual.

USER ACCESSIBLE MONITOR ROUTINES AND VARIABLES

This section gives the locations and calling sequences of the user accessible I/O routines in the XEROX 820 monitor. It also describes a number of important monitor variables that may need to be accessed by user written programs.

XEROX 820 subroutines are accessed via a table of JUMP instructions beginning at memory location F000 hex. All monitor calls should be made to these entry points, since the actual addresses of the routines inside XEROX 820 will vary between different releases. Parameter passing conventions for the monitor fall into one of two groups. The character oriented I/O routines all pass data using the A register, while the disk routines pass parameters in C and HL and return status information in A.

Storage for the monitor's stack and working variable occupies the top 256 bytes of memory, from FF00 to FFFF hex. The mode 2 interrupt vector table takes up the first 32 bytes of this block and the stack starts at the very top. In between, are variables used by the monitor resident I/O drivers and interrupt service routines, some of which are described below. Programs should not attempt to write into any locations in this block that are not specifically mentioned below.

1) XEROX 820 SUBROUTINE ENTRY POINTS

```
F000    ENTO:   JP    INIT      ;XEROX 820 cold start entry
F003    ENT1:   JP    PROMPT    ;XEROX 820 warm start entry
F006    ENT2:   JP    CONST     ;console input status test
F009    ENT3:   JP    CONIN     ;console input
F00C    ENT4:   JP    CRTOUT    ;memory-mapped CRToutput
F00F    ENT5:   JP    CRTOUT    ;memory-mapped CRToutput
F012    ENT6:   JP    SIOST     ;SIO port B input status test
F015    ENT7:   JP    SIOIN     ;SIO port B input
F018    ENT8:   JP    SIOOUT    ;SIO port B ouput
F01B    ENT9:   JP    SELECT    ;disk drive select
F01E    ENT10:  JP    HOME      ;restore to track 0
F021    ENT11:  JP    SEEK      ;seek track
F024    ENT12:  JP    READ      ;read sector into memory
F027    ENT13:  JP    WRITE     ;write sector from memory
```

FUNCTION	PARAMETERS	DESCRIPTION
COLD . . .	IN: none OUT: does not return	Perform cold start initialization of XEROX 820 monitor and enter command mode.
WARM . . .	IN: none OUT: does not return	Enter XEROX 820 monitor command mode with no re-initialization.
CONST . . .	IN: none OUT: status in a	Test for data ready in console input FIFO and return status in A. If data is available then A=FF, else A=00 hex.
CONIN . . .	IN: none OUT: character in A	Return character from console input FIFO in A. If FIFO is empty then loop until character is input.
CONOUT . .	IN: character in A OUT: none	Output character passed in A to the memory mapped CRT display
CRTOUT . .	IN: character in A OUT: none	Output character passed in A to the memory-mapped CRT display.
SIOST . .	IN: none OUT: status in A	Test for received data available from SIO channel B and return status in A. if data is available then A=FF, else A=00 hex.
SIOIN . . .	IN: none OUT: character in A	Return received data from SIO channel B in A. Loop until data is received if none is available on entry.
SIOOUT . . .	IN: character in A OUT: none	Output character passed in A to SIO channel B transmit register.
SELECT . . .	IN: unit number in C OUT: status in A	Select specified drive for future restore, seek, read or write command. If the drive is not ready, then the currently selected drive is left on.
HOME . . .	IN: none OUT: status in A	Move read/write head to home position at track 0 and verify if it got there.
SEEK . . .	IN: track number in C OUT: status in A	Move read/write head to specified track and verify if it got there.
READ . . .	IN: sector number in C buffer pointer in HL OUT: status in A	Read specified sector on current track into memory data buffer.

WRITE . . .	IN:	sector number in C buffer pointer in HL	Write specified sector on current Track from memory data buffer.
	OUT:	status in A	

2) STORAGE ALLOCATION FOR XEROX 820 VARIABLES

(INTERRUPT VECTOR TABLE)

```
FF00 SIOVO:     DEFS2     ;SIO port B xmit buffer empty
FF02 SIOV1:     DEFS2     ;SIO port B external/status change
FF04 SIOV2:     DEFS2     ;SIO port B receive data available
FF06 SIOV3:     DEFS2     ;SIO port B special receive condition
FF08 SIOV4:     DEFS2     ;SIO port A xmit buffer empty
FF0A SIOV5:     DEFS2     ;SIO port A external/status change
FF0C SIOV6:     DEFS2     ;SIO port A receive data available
FF0E SIOV7:     DEFS2     ;SIO port A special receive condition

FF10 CTCVO:     DEFS2     ;CTC channel 0 interrupt
FF12 CTCV1:     DEFS2     ;CTC channel 1 interrupt
FF14 CTCV2:     DEFS2     ;CTC channel 2 interrupt
FF16 CTCV3:     DEFS2     ;CTC channel 3 interrupt

FF18 SYSVA:     DEFS2     ;system PIO port A interrupt
FF1A SYSVB:     DEFS2     ;system PIO port B interrupt

FF1C GENVA:     DEFS2     ;general purpose PIO port A interrupt
FF1E GENVB:     DEFS2     ;general purpose PIO port B interrupt
```

(CONSOLE KEYBOARD INPUT VARIABLES)

```
FF20 FIFO:      DEFS16    ;input data fifo buffer
FF30 FIFCNT:    DEFS1     ;number of characters in FIFO
FF33 LOCK:      DEFS1     ;character used for software shift
```

Theory of Operation -- CENTRAL PROCESSOR

CLOCK GENERATOR:

All the system clocks with the exception of the baud clock and the video dot clock are generated from a master oscillator operating at 20 Mhz. The 20 Mhz clock is scaled by the divide-by-5 section of decade counter to provide 4 Mhz for use in the floppy disk data separator. The 2 Mhz clock for the disk controller is generated from the 4 Mhz clock by the remaining divide by two section.

The 2.5 Mhz processor clock is generated by dividing the master 20 Mhz clock by 8 with binary counter. The column address strobe "CAS", and the address multiplexer control "MUXC", are derived from the 20 Mhz clock. When memory request "MREQ" is low and refresh "RFSH" is high generation of "CAS" and "MUXC" is enabled. "RFSH" disables the generation of "CAS" and "MUXC" by holding shift register reset. This is done to take advantage of the low power row address strobe "RAS" only refresh mode of the 16K dynamic RAM.

RESET CONTROLLER:

Two types of reset take place on the board. Power on reset is detected and conditioned by part of hex schmitt inverter. The pushbutton reset is also conditioned by a part of hex schmitt inverter.

PORT ADDRESS DECODING:

Octal decoder is used to select the appropriate I/O device based on the binary value of the address bits A2, A3, & 4. When A7 is low and "M1R" is high, a low on "IORQ" will cause the appropriate output of the decoder to go low, selecting the I/O device for a read or write operation.

PORT 0-3 = CHANNEL A BAUD RATE (WRITE ONLY)
PORT 4 = SIO CHANNEL A DATA
PORT 5 = SIO CHANNEL B DATA
PORT 6 = SIO CHANNEL A CONTROL
PORT 7 = SIO CHANNEL B CONTROL
PORT 8 = GP PIO PORT A DATA
PORT 9 = GP PIO A CONTROL
PORT A = GP PIO PORT B DATA
PORT B = GP PIO PORT B CONTROL
PORT C-F = CHANNEL B BAUD RATE (WRITE ONLY)
PORT 10 = 1771 STATUS/COMMAND REGISTER
PORT 11 = 1771 TRACK REGISTER
PORT 12 = 1771 SECTOR REGISTER
PORT 13 = 1771 DATA REGISTER
PORT 14-17 = CRT SCROLL REGISTER (WRITE ONLY)
PORT 18 = CTC CHANNEL 0
PORT 19 - CTC CHANNEL 1
PORT 1A = CTC CHANNEL 2
PORT 1B = CTC CHANNEL 3
PORT 1C = SYSTEM DATA PORT
PORT 1D = SYSTEM CONTROL PORT
PORT 1E = KEYBOARD DATA PORT
PORT 1F = KEYBOARD CONTROL PORT

DISK TRANSFER SYNCHRONIZATION:

In order to successfully execute the high speed data transfers between the processor and the disk controller, the fast Z-80 non maskable interrupt "NMI" response was employed. During reads and writes to and from the disk controller, the data at memory location 66 hex is retrieved and stored. This location is overwritten with a RETURN instruction. After this setup is accomplished the processor executes a HALT instruction. When the processor is in a HALT condition, a DATA REQUEST (DRQ) or an INTERRUPT REQUEST (IRQ) from the disk controller will cause a non-maskable interrupt to be generated. The processor then executes the RETURN instruction at 66 hex and returns to transfer the data to or from the disk controller. When the 128 byte transfer is complete the old data is restored and the processor resumes normal operation. This hardware assistance obviated the necessity for a DMA device by eliminating the disk controller "DRQ" status test.

CRT DISPLAY CONTROLLER

VIDEO SCROLLING:

In order to eliminate the delay associated with software scrolling, hardware assistance was employed. For ease of understanding, the CRT RAM resides from 3000 hex to 3FFF hex. Writing into the scroll register adds an offset to the line address developed by the line counter. The net effect is similar to the rotation of a cylinder whose axis is horizontal and perpendicular to the line of shift. The amount of rotation is determined by the magnitude of the number contained in the scroll register. For instance, an offset of zero puts the data at location 3000 hex (of the CRT memory) at the bottom of the screen. If the offset was one, the data at 3000 hex would be displayed on the line next to the bottom. An offset of seventeen hex (23 decimal) puts the data at location 3000 hex at the top of the screen.

VIDEO RAM ADDRESSING:

If the processor is doing a read or write to video RAM "CRTCE" (CRT memory access enable) will go low. When "CRTCE" goes low, the address from the processor is selected instead of the address generated by the counter chain. This gives the processor access to the video RAM for read or write operations.CPU ACCESS OF VIDEO RAM:

During read or write operations involving the video RAM and the CPU, "CRTCE" will go low. When "CRTCE" goes low the processor address bus is selected as the address source for the video RAM. A low on "CRTCE" is also used as a term in the direction control logic for data buss access. During a processor read operation, data from the video RAM at the specified address is allowed onto the processor data bus. During a processor write operation, data from the processor is written to the video RAM at the specified address.

VIDEO GENERATION:

While in the display mode, ASCII data from the video RAM and scan address data are used to select the proper dot patterns from the character generator. The character generator contains 1 Font pattern of 128 characters.

DISPLAY BLANKING:

The display is blanked during horizontal retrace, vertical retrace, CPU access, and decode of scan counts 8 & 9. Blanking is accomplished by disabling the character generator.

64 K RAM AND BANK SWITCHING

REFRESH:

During the refresh cycle, the Z-80 places the refresh address on the lower 7 bits of the address bus. When this address is stable in the RAM array, th "RFSH" pin on the Z-80 goes low. The active low "RFSH" generates a "RAS" on all RAMs. An active "RFSH" disables the generation of both "CAS" and "MUXC" .

BANK SWITCHING:

Bit 7 of port 1C hex is the bank switch control. When the output is high, the ROMs and the CRT display appear in the lower 16K block. When bit 7 of port 1C hex is low, all the 64K RAM is available to the processor.

FLOPPY DISK CONTROLLER, SYSTEM PIO, AND CTC

FLOPPY DISK CONTROLLER:

The 1771 Disk Controller performs all the control functions required to interface to a floppy disk drive. The only support required by the 1771 is external data separation, inverting data bus transceivers, head load timer, and buffering to and from the drive(s).

DATA SEPARATOR:

Presettable counter is used as a timing reference developed by the system clock. Raw data coming from the disk drive is used to preload the counter. If the counter does not receive a data bit between clocks the counter in effect times out and presents the controller with a logic zero. If the counter receives data between clocks, the controller will see a logic one on its data input.

DATA BUS BUFFERING:

Inverting transceivers adapt the 1771 to the non-inverted Z-80 data bus. During a read operation, data from the 1771 is allowed onto the processor's data bus. Otherwise, the processor's data bus always drives the 1771's data inputs.

CTC:

The CTC resides at ports 18 hex through 1B hex (see page 10-38). All the inputs and outputs associated with the CTC are available to the user. Refer to the strapping option section for pin assignments.

SYSTEM PIO:

The system PIO resides at ports 1C hex through 1F hex. The "A" side of the system PIO controls the floppy disk drive select, bank switching, disk power switching, sensing keyboard data available (for polled keyboard applications), and on uncommitted user definable I/O bit. The bit allocations are as follows:

BIT 0 = DVSEL 1
BIT 1 = DVSEL 2
BIT 2 = SIDE
BIT 3 IS USED FOR KEYBOARD DATA AVAILABLE
BIT 4 IS 8"/5¼" DISK SELECT
BIT 5 ASSIGNED FOR FUTURE USE
BIT 6 CONTROLS DISPLAY CHARACTER SET
BIT 7 CONTROLS THE BANK SWITCHING (0=RAM)

The drive select information should be presented to the system PIO in the following manner:

read port 1C hex to maintain system status data
mask off the lower 3 bits
"or" in the desired drive & side information
write the modified data to port 1C hex

The "B" side of the system PIO is devoted to the keyboard. The keyboard port is eight bits wide and is fully buffered.

GENERAL PURPOSE PIO AND SIO

The G.P. PIO provides the user with 16 bits of user definable input or output or a mix of input and output on nibble boundaries. The G.P. PIO resides at ports 08 hex -0B hex. The PIO will support all modes of interrupt supported by the Z-80. For detailed programming information refer to the Z-80 PIO data sheet. For applications information, refer to the strapping option section.

SIO:

The Z-80 SIO supports two full channels of serial I/O with the capability of supporting full RS-232 protocol on both channels. In addition, the A side of the SIO can provide clocks to synchronous modems or receive clocks from the modem.

Channel A of the SIO can be configured to interface to a modem or a terminal. Refer to the strapping option sheets for detailed instructions. Refer to the SIO data sheet for programming information.

Channel B of the SIO is dedicated for printer operation and has no strapping options.

The "SYNC" pins on both channels of the SIO have been connected to the Rx data pins to facilitate baud rate selection. Utilizing this feature, the start bit duration can be timed, and the baud rate can be set accordingly.

BAUD RATE GENERATOR:

The COM 8116 provides the user with two programmable baud rate generators. Channel A baud rate resides at port 00 hex and is write only. Channel B baud rate resides at port 0C hex and is also write only. The programming procedure is as follows:

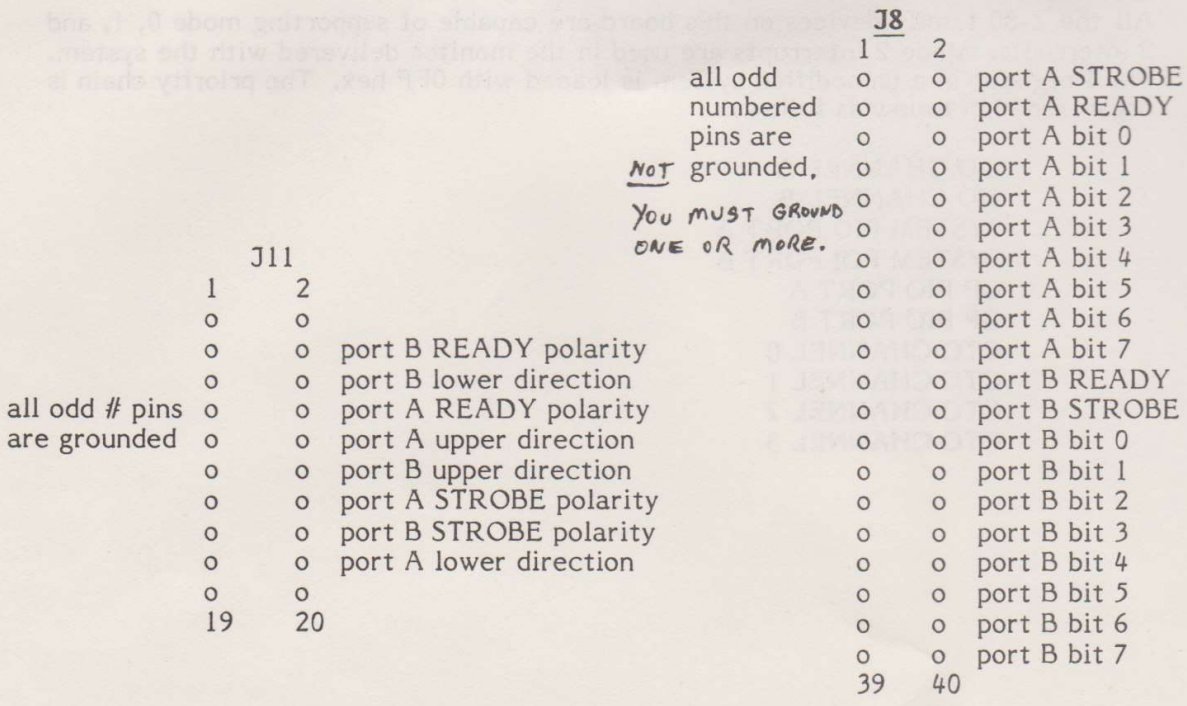
00 hex = 50 Baud
01 hex = 75 Baud
02 hex = 110 Baud
03 hex = 134.5 Baud
04 hex = 150 Baud
05 hex = 300 Baud
06 hex = 600 Baud
07 hex = 1200 Baud
08 hex = 1800 Baud
09 hex = 2000 Baud
0A hex = 2400 Baud
0B hex = 3600 Baud
0C hex = 4800 Baud
0D hex = 7200 Baud
0E hex = 9600 Baud
0F hex = 19.2 Kbaud

INTERRUPT STRUCTURES:

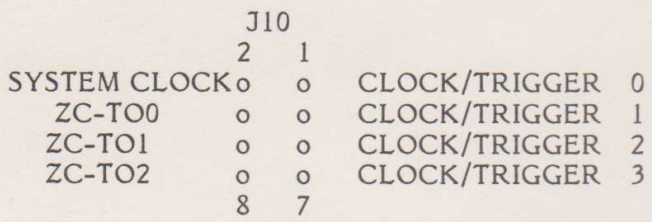
All the Z-80 family devices on this board are capable of supporting mode 0, 1, and 2 interrupts. Mode 2 interrupts are used in the monitor delivered with the system. The I register in a unmodified system is loaded with 0FF hex. The priority chain is organized high to low as follows:

SIO CHANNEL A
SIO CHANNEL B
SYSTEM PIO PORT A
SYSTEM POI PORT B
GP PIO PORT A
GP PIO PORT B
CTC CHANNEL 0
CTC CHANNEL 1
CTC CHANNEL 2
CTC CHANNEL 3

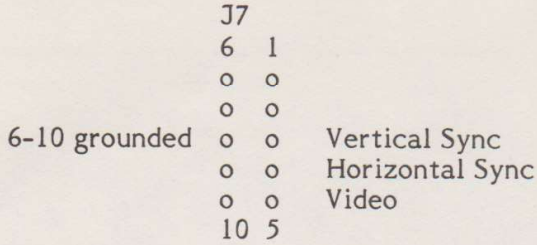
GENERAL PURPOSE PIO STRAPPINGS (J11) AND PIN ASSIGNMENTS (J8)



CTC STRAPPING AND I/O ASSIGNMENTS (J10)



VIDEO OUTPUT CONNECTOR PIN ASSIGNMENTS (J7)



SERIAL I/O CONNECTOR PIN ASSIGNMENTS CHANNEL A (J4)

J4

	1	14	
PROTECTIVE GROUND	o	o	
TRANSMIT DATA	o	o	TRANSMIT CLOCK
RECEIVE DATA	o	o	
REQUEST TO SEND	o	o	RECEIVE CLOCK
CLEAR TO SEND	o	o	
DATA SET READY	o	o	
PROTECTIVE GROUND	o	o	DATA TERMINAL READY
CARRIER DETECT	o	o	
	o	o	
	o	o	
	o	o	
	o	o	
	o	25	
	13		

SERIAL I/O STRAPPING OPTIONS FOR CHANNEL A (J9)

Only channel A is capable of utilizing baud clocks from an external device or of providing baud clocks to an external device. When providing the baud clock to the external device the SIO must use the same clock source.

J9

	1	2	
	o	o	
	o	o	
	o	o	(M) RXD to Pin 3
	o	o	(T) TXD to Pin 2
	o	o	(M) TXD from Pin 2
	o	o	(T) RXD from Pin 3
	o	o	(M) CTS to Pin 5
	o	o	(T) RTS to Pin 4
	o	o	(M) RTS from Pin 4
	o	o	(T) CTS from Pin 5
	o	o	(M) DCD to Pin 8
	o	o	(T) DTR to Pin 20
	o	o	(M) DTR from Pin 20
	o	o	(T) DCD from Pin 8
Clock supplied to Modem as RX Clock	o	o	
Clock supplied to SIO with RX Clock	o	o	
Modem supplies SIO with RX Clock	o	o	
Clock supplied to SIO with TX Clock	o	o	
Modem supplies SIO with TX Clock	o	o	
Clock supplied to Modem with TX Clock	o	o	
	39	40	

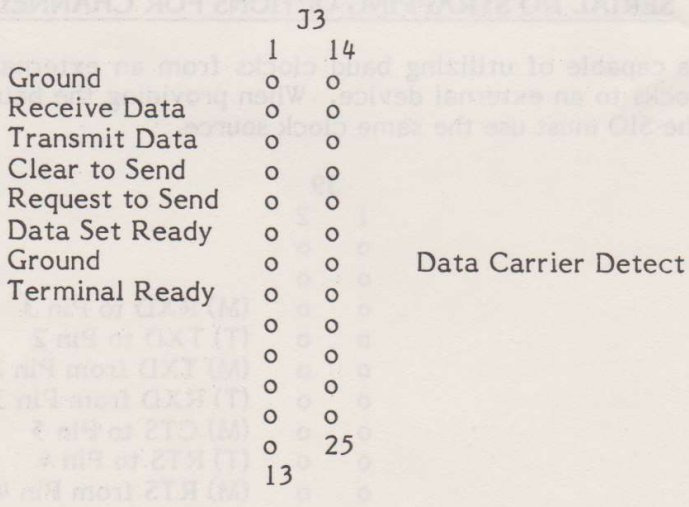
DATA SET READY IS ACTIVE ON BOTH CHANNELS

Legend
(M) Indicates modem (Data Commuinications Equipment) function
(T) Indicates terminal (Data Terminal Equipment) function

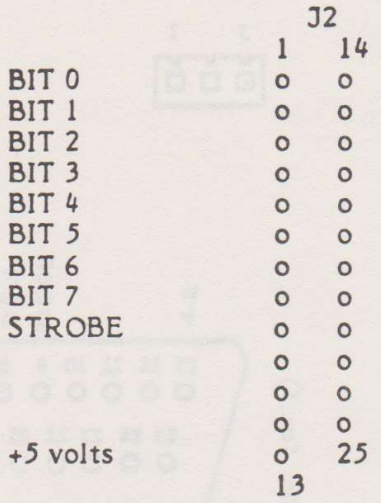
For instance, exercising the (T) strap options will allow communication with a modem. Exercising the (M) strap options would allow communication with a terminal.

TXD = Transmitted Data
RXD = Received Data
RTS = Request to Send
CTS = Clear to Send
DTR = Data Terminal Ready
DCD = Data Carrier Detect

SERIAL I/O CONNECTOR PIN ASSIGNMENTS CHANNEL B (J3)

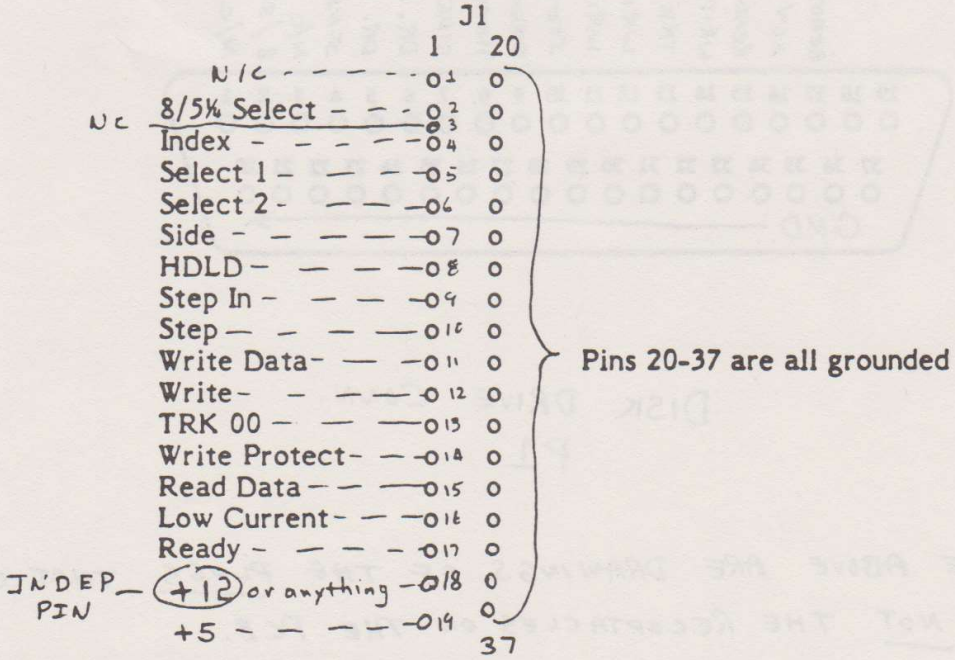


KEYBOARD CONNECTOR PIN ASSIGNMENTS (J2)

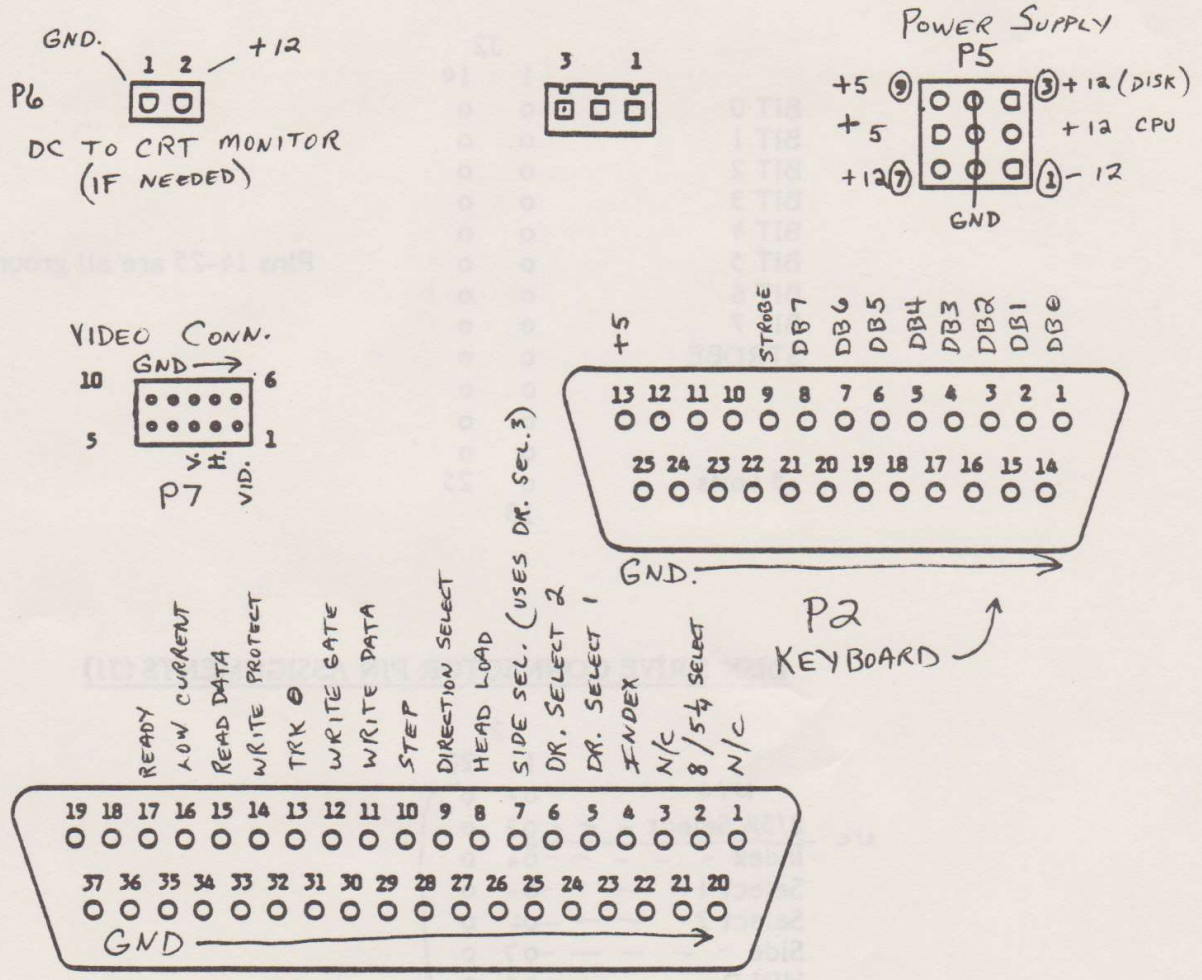


Pins 14-25 are all grounded

DISK DRIVE CONNECTOR PIN ASSIGNMENTS (J1)



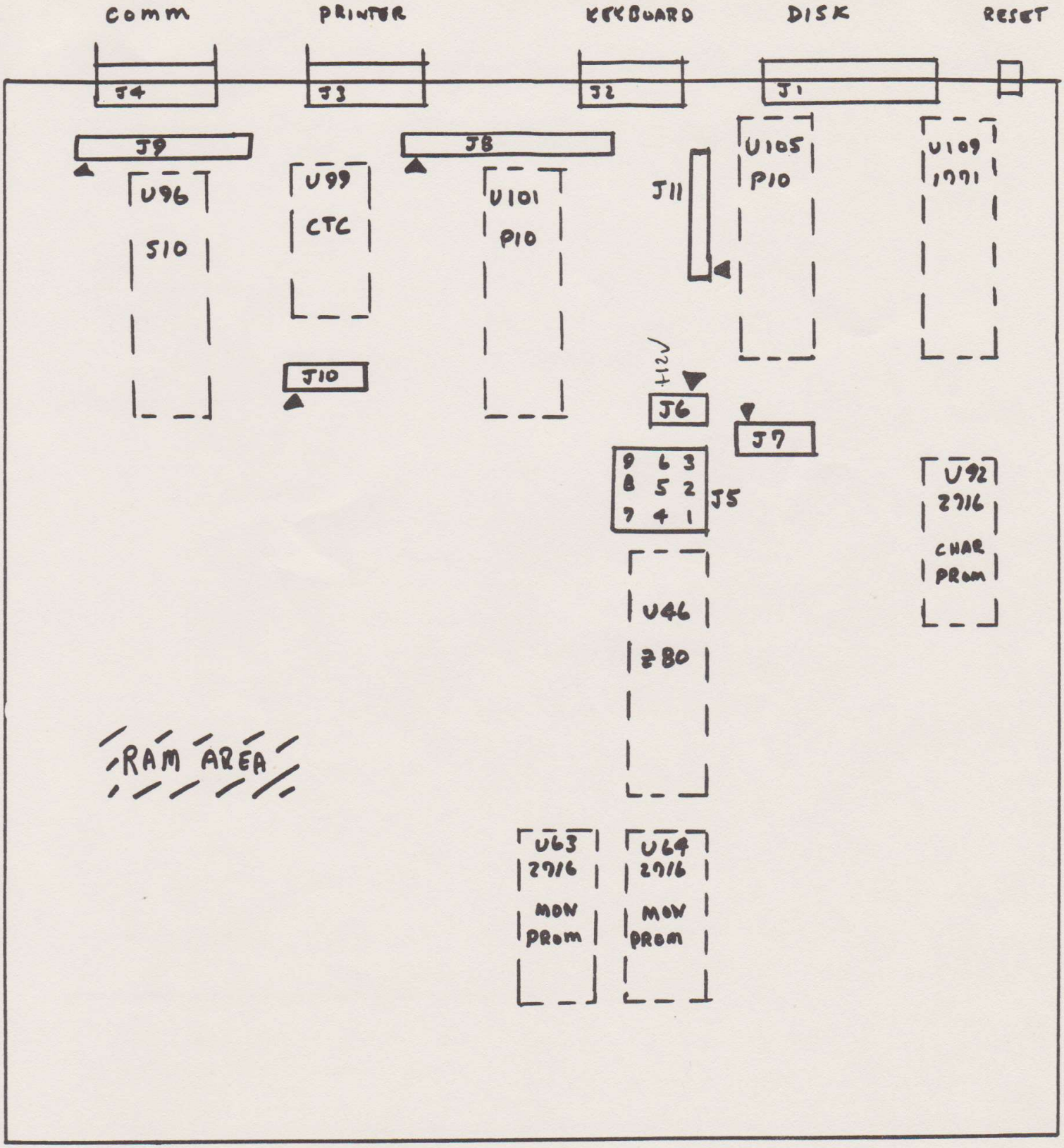
Pins 20-37 are all grounded



DISK DRIVE CONN.
P1

ALL OF THE ABOVE ARE DRAWINGS OF THE PLUGS THAT GO TO THE 820 — NOT THE RECEPTACLES ON THE PCB.

NOTE: PAR. OUTPUT CONN. ARE NOT SHOWN. ALL ODD PINS ON THE PAR. PORT CONN. ARE SUPPOSED TO BE GROUNDED. BUT THE HAVE NOT BEEN. AT LEAST ONE OF THESE PINS SHOULD BE JUMPERED TO THE GROUND PIN ON THE PIO CHIP. THIS WILL BE THE SIGNAL GROUND FOR THE PORT.


Comm
PRINTER
KEYBOARD
DISK
RESET
J4
J3
J2
J1
J9
J8
J11
U96
S10
U99
CTC
J10
U101
P10
U105
P10
U109
1791
+12V
J6
J7
9 6 3
8 5 2
7 4 1
J5
U92
2716
CHAR
PROM
U46
Z80
RAM AREA
U63
2716
MON
PROM
U64
2716
MON
PROM